

A white soldier, aged 20 years, with a lesion of the left parietal region had headaches, dizziness, and trouble with his eyes. There was nothing more specific in the history.

Finally, a white soldier, aged 23 years, had lesions of the left and right sides of the skull, as well as multiple lesions elsewhere. His right pupil was slightly irregular, but there were no other abnormalities noted in either eye.

As far as I know, no definite correlation has been made between the eye findings and the skull lesions, but the 44 cases are being prepared for publication by Dr. Sophie Spitz, recently of the Museum staff.

INDICATIONS AND CONTRAINDICATIONS FOR KERATOPLASTY AND KERATECTOMIES*

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The surgical procedures used for the treatment of corneal opacities are keratoplasty and keratectomies. Whenever possible keratoplasty is to be preferred because the visual acuity obtained with this type of operation is considerably better than that which can be obtained with keratectomies.

With keratoplasty, when the transplant remains completely transparent it is not rare to obtain vision of 20/20 or better, while with keratectomies there is always a certain amount of irregular astigmatism and varying degrees of haziness with which vision is rarely improved to beyond 20/100. This presentation is based upon the study of more than 600 keratoplasties and over 100 keratectomies performed at the Institute of Ophthalmology, Columbia Presbyterian Medical Center.

Inflammation contraindicates keratoplasty and keratectomies. Whether the inflammation is due to disease (infection, specific lesions, or conditions caused by viruses) or following trauma, the operation should be postponed until

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all signs of inflammation have subsided and the eye has remained quiet for at least six months.

In cases of burns caused by chemicals, flame, and molten metals it is advisable to wait about a year until cicatrization has been completed and photophobia, blepharospasm, and lacrimation have disappeared. Then, when the eye is quiet, the sequela of the injury may be treated either by keratoplasty or keratectomies.

Glaucoma contraindicates these operations. In glaucomatous eyes with corneal opacities, where improvement of vision may be expected by keratoplasty or keratectomies, the glaucomatous state has to be treated first by appropriate operations. When an operation for the control of glaucoma is performed as a preliminary to a keratoplasty, it is advisable to make a very large iridectomy. This will leave the eye in a more favorable condition for the keratoplasty with less danger of anterior synechia and recurrence of glaucoma. These complications often lead to nebulosity or opacification of the graft.

In regard to prognosis after keratoplasty and keratectomies, patients may be divided into three main groups:

1. These are very favorable cases for keratoplasty in which a high percentage of clear grafts and considerable improvement of vision may be expected with final vision averaging better than 20/50 and not infrequently 20/20 or better.

2. Central corneal opacities where the transplant will remain surrounded by healthy corneal tissue (Fig. 1).

Keratoconus, when vision cannot be improved by regular or contact lenses or when the contact lenses are not tolerated. In these cases the transplant has to be large enough to include the conus, otherwise the transplant has a tendency to heal unevenly around the edges and in some instances may protrude causing pronounced astigmatism or myopia and thus defeating the purpose of the operation (Fig. 2).

3. Interstitial keratitis, when the opacity is not too dense and extensive and the transplant will remain in contact with

fairly healthy corneal tissue. To prevent a recurrence of the interstitial keratitis and subsequent nebulosity or opacification of the graft, the infection responsible for the keratitis must be cleared or at least treatment of the infection well advanced before the keratoplasty is performed (Fig. 3).

2. These are less favorable for keratoplasty but still likely to give a high percentage of transparent grafts and considerable improvement of vision.

Corneal dystrophies (the Fleischer, Haab-Dimmer, Groenow, and Salzmann's types) (Fig. 4).

Superficial opacities extending over the whole area of the cornea in which the epithelium has a healthy appearance, there is not superficial vascularization, and it can be seen either by observation with the naked eye, oblique illumination, or examination with the slit lamp that most of the stroma and the inner layers of the cornea are normal (Fig. 5).

Tear gas burns when there is no pannus type superficial vascularization, the destruction of the cornea includes only a limited area of the superficial layers, and enough healthy cornea remains underneath to nourish the graft (Fig. 6).

Adherent leucomas. Keratoplasty should be preceded by an iridectomy to free the iris from the corneal scar.

Descemetocelles (following corneal ulcers or surgical procedure) in or near the pupillary area when the whole opacity including the descemetocelle may be substituted by a corneal graft (Fig. 7).

Interstitial keratitis with more extensive and denser opacity than that already mentioned in paragraph 3 under Group 1, but still with sufficient permeability in the corneal stroma, giving reason to suppose that the transplant will remain more transparent than the original opacity (Fig. 8).

3. These are unfavorable for keratoplasty.

Corneal scars which, including the pupillary area, extend to the limbus. In these cases the transplant is likely to become vascularized and subsequently nebulous or opaque. Keratoplasty in these cases may be performed with guarded

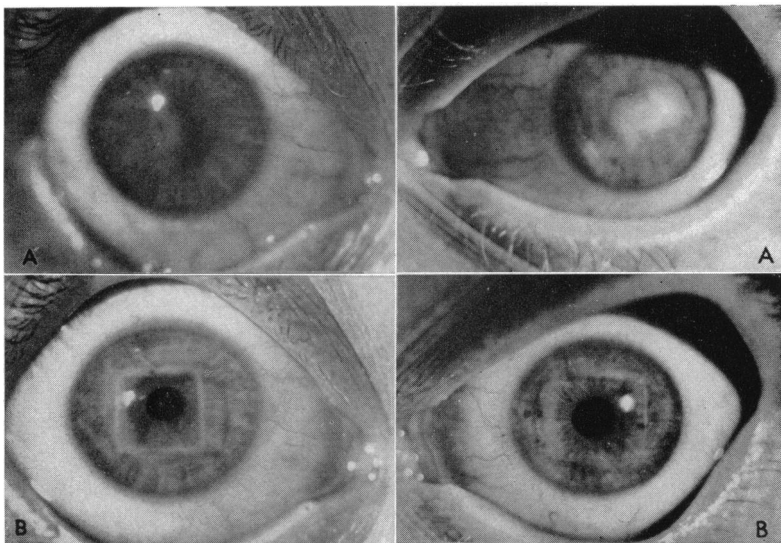


Fig. 1.—Eyes with central corneal opacities before (A) and after (B) keratoplasty.

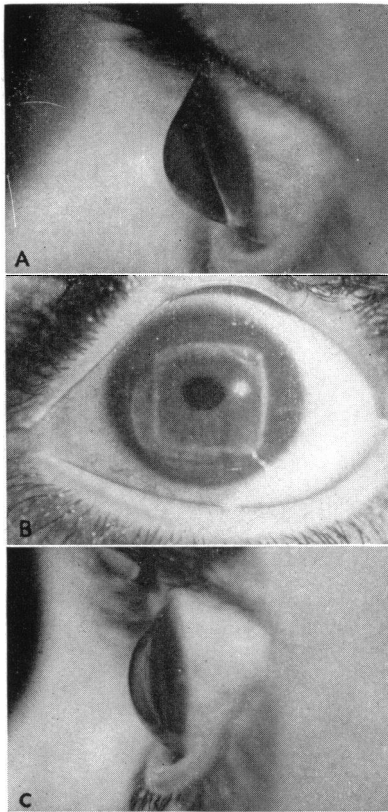


Fig. 2.—Keratoconus, before (A) and after (B and C) keratoplasty.

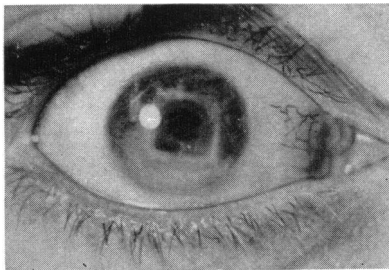


Fig. 3.—The result of keratoplasty in a case of interstitial keratitis.

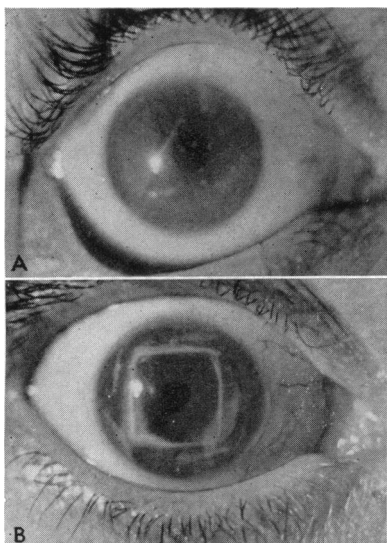


Fig. 4.—Corneal dystrophy, before (A) and after (B) keratoplasty.

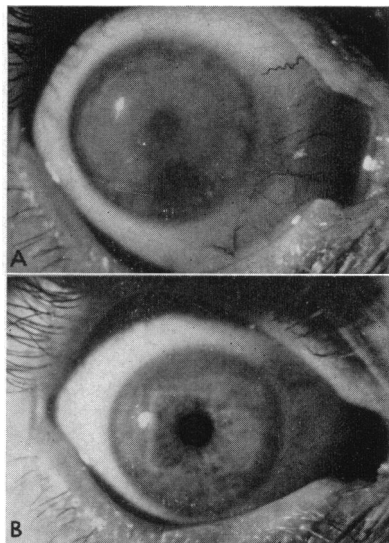


Fig. 5.—Extensive superficial corneal opacity, before (A) and after (B) keratoplasty.

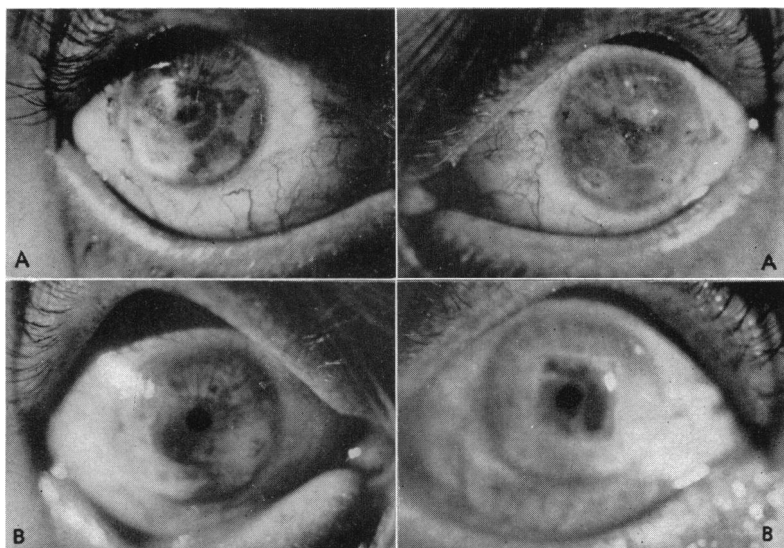


Fig. 6.—Tear gas burns of cornea, before (A) and after (B) keratoplasty.

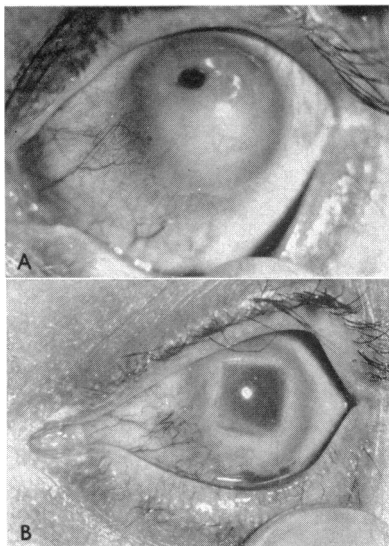


Fig. 7.—Corneal opacity with descemetocoele, before (A) and after (B) keratoplasty.

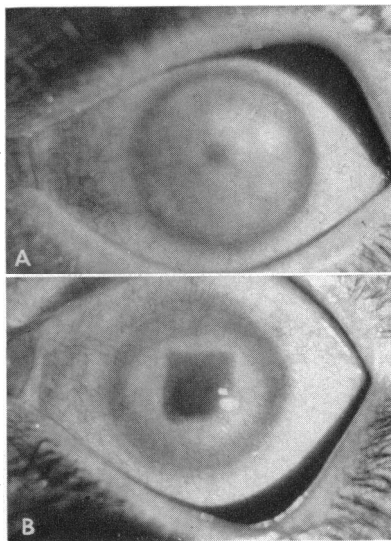


Fig. 8.—Extensive and dense interstitial keratitis, before (A) and after (B) keratoplasty.

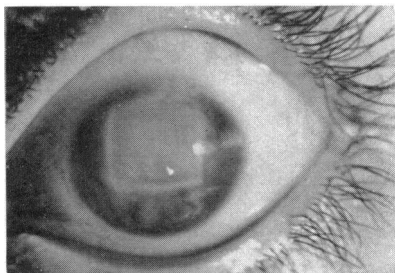


Fig. 9.—Nebulous transplant in an example of corneal scar extending to the limbus.

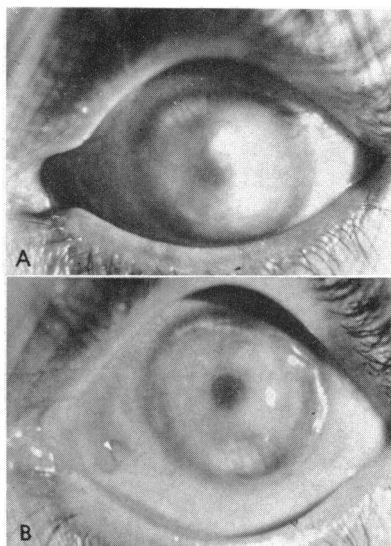


Fig. 10.—Extensive corneal leucoma before (A) and after (B) partial superficial keratectomy.

prognosis preceded by a preliminary large iridectomy corresponding to the corneal opacity. If the transplant should become nebulous the eye is generally left in a more favorable condition to undergo a second keratoplasty in the pupillary area because the cornea is usually left with a haziness which is not as dense as the original leucoma (Fig. 9).

Extensive leucomas in which the transplant will be surrounded in more than one half of its circumference by dense scar tissue. In these cases a partial superficial keratectomy removing as much as possible of the thickness of the scar may improve vision. If, after keratectomy, vision has not improved as much as desired, the eye is left in a more favorable condition to undergo a keratoplasty (Fig. 10).

Band-shaped opacity. In these cases the transplant generally becomes invaded by the opacity and it is preferable to perform a partial superficial keratectomy excising the affected area of the cornea.

Dystrophia adiposa. The transplant is invariably invaded by the dystrophy and becomes opaque (Fig. 11). In these cases it is preferable to perform a partial superficial keratectomy as extensive as may be necessary to excise the whole affected area, in surface and in depth, preserving as much as possible of the normal peripheral corneal epithelium which will serve to epithelialize the dissected corneal area.

Deep corneal burns with tear gas whether the eye is quiet or with photophobia, blepharospasm, and lacrimation. In these cases it is advisable to carry out a partial superficial keratectomy, removing all of the superficial affected area as deeply as necessary to reach clear corneal tissue without perforation. With this procedure enough vision may be obtained to make further surgery unnecessary, but if the improvement of vision obtained is not enough, the eye is generally left without photophobia, blepharospasm, and lacrimation in a more favorable condition to undergo a keratoplasty.

Extensive corneal opacities caused by explosions which

leave the cornea with a tattooed appearance. A partial superficial keratectomy is likely to improve vision sufficiently; if not a keratoplasty may be performed afterward with better chance of success (Fig. 12).

Corneal opacities in aphakic eyes, particularly after intra-capsular cataract extraction. These cases are unfavorable because the iris, capsule of the lens or vitreous are likely to become incarcerated in the corneal incision. This complication is very likely to render the transplant quite nebulous or opaque.

Extensive corneal opacities with superficial vascularization of the pannus type generally caused by burns (chemical, flame, or molten metals) do not lend themselves well to keratoplasty and the transplant invariably becomes opaque (Fig. 13). These cases are better treated by superficial keratectomies. If the opacity does not extend over the whole area of the cornea the healthy cornea should be preserved, dissecting only the superficial layers of the cornea including the opacity with the blood vessels. The operation must be followed by X-ray treatments to prevent the recurrence of corneal vascularization. If the opacity extends over the whole corneal area a total superficial keratectomy is to be performed followed by radiation to prevent the recurrence of corneal vascularization (Fig. 14). If, besides an opacity of the cornea, there is a symblepharon, a total superficial keratectomy for visual purposes has to be combined with corneo-conjunctival plastic (Fig. 15), or corneo-conjunctival plastic and buccal mucosa implant for the correction of the symblepharon.

Fuch's epithelial dystrophy, extensive corneal opacities with calcareous degeneration, corneal opacities caused by pemphigus, and corneal opacities with extensive anterior synechiae do not lend themselves to keratoplasty or keratectomies (Fig. 16).

Eyes with corneal opacities of many years standing, particularly when there is a pronounced nystagmus, are not

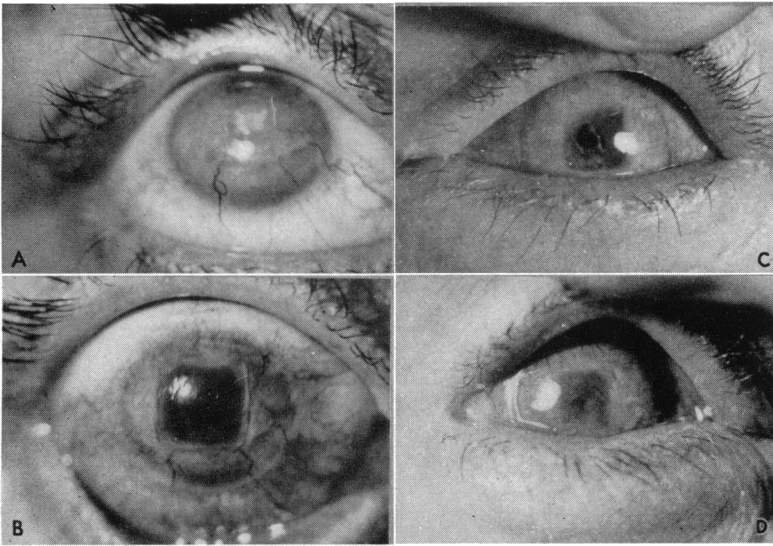


Fig. 11.—Dystrophia adiposa. Before keratoplasty (A). One month after keratoplasty (B). (This graft became opaque several weeks later.) Stages in opacification of the graft after keratoplasty (C and D).

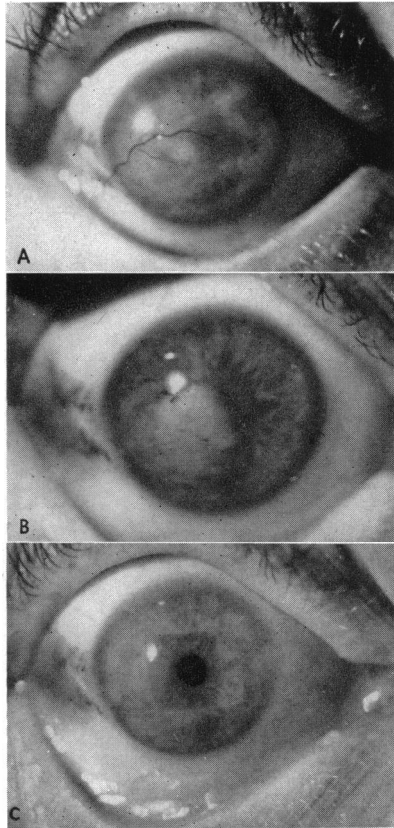


Fig. 12.—Corneal opacity after dynamite explosion. Before operation (A). After preliminary partial superficial keratectomy (B). After subsequent keratoplasty (C).

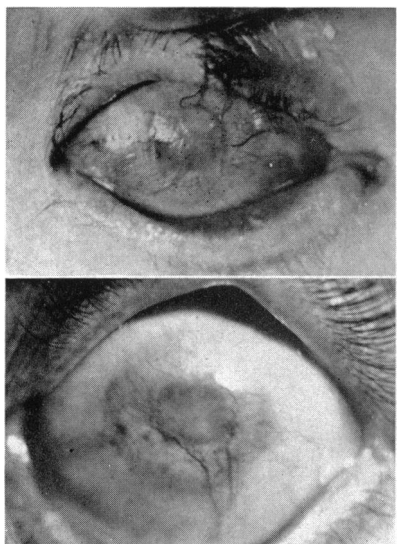


Fig. 13.—Opaque transplants after keratoplasty in two examples of dense vascularized leukomas of the cornea.

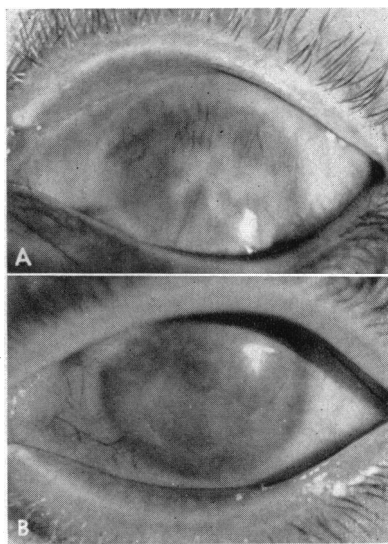


Fig. 14.—Dense vascularized leukoma before (A) and after (B) total superficial keratectomy.

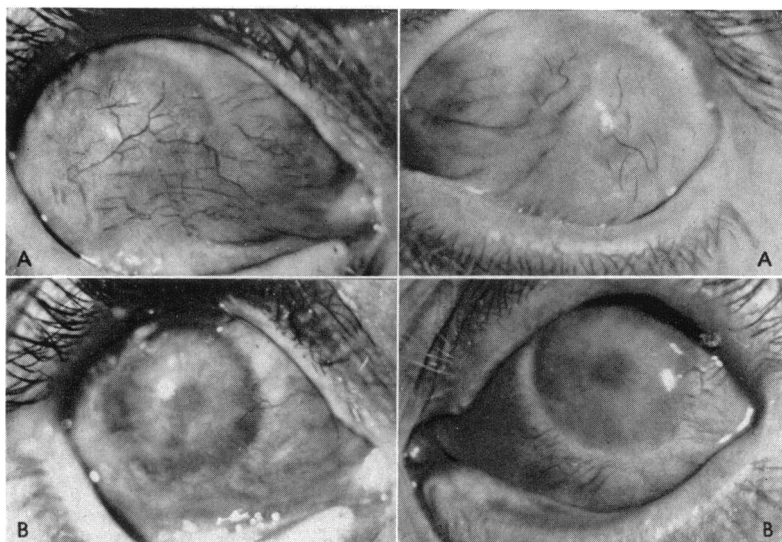


Fig. 15.—Dense vascularized leukoma and symblepharon before (A) and after (B) total superficial keratectomy with corneo-conjunctival plastic operation.

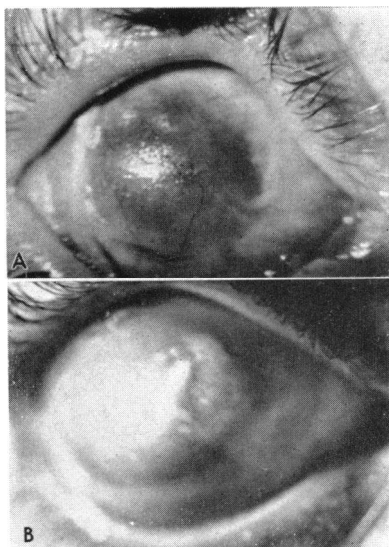


Fig. 16.—Example of cases unfavorable to corneal surgery. Pemphigus (A). Corneal opacity with calcareous degeneration in a glaucomatous eye (B).

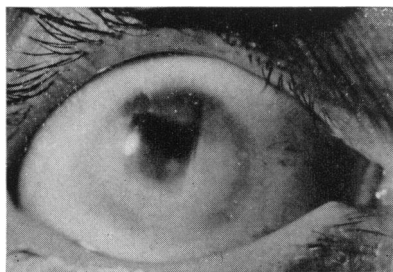


Fig. 17.—Clear corneal transplant in a case of corneal scar with pronounced nystagmus.

suitable for keratoplasty for visual purposes because these eyes have a high degree of amblyopia. Although the transplant may remain transparent, vision does not improve (Fig. 17).

Keratoplasty is contraindicated even in the presence of a favorable eye in patients who during the examination are very unco-operative, the so-called high-strung type. In these it is reasonable to assume that, on account of poor co-operation, the postoperative recovery will be stormy with great danger of severe complications such as extensive anterior synechiae and subsequent secondary glaucoma or prolapse of the transplant leading to loss of the eye.

COMMENT

Keratoplasty and keratectomies are no longer surgical procedures of uncertain results. Sufficient numbers of cases have already been studied to determine fairly accurately in which cases this type of surgery will be helpful. Further study of cases operated upon by keratoplasty or keratectomies will give additional data in regard to the feasibility of employing these technics in a greater variety of corneal affections, particularly with reference to those cases which at present are considered unfavorable.

DISCUSSION

DR. WILLIAM H. CRISP, Denver, Colo.: I shall be obliged if Dr. Castroviejo will tell us something about the very extreme cases of keratoconus, rarely seen, in which there is great bulging of the cornea and some cloudiness of the apex of the extreme cone.

I should also be obliged if Dr. Castroviejo would tell us a little more as to whether one may expect any gain from X-ray treatment of general vascularity from a tear gas burn many years after the accident occurred.

DR. F. H. VERHOEFF, Boston, Mass.: I wish to ask Dr. Castroviejo his opinion as to the possibility of recurrence of corneal dystrophy in a graft, and whether in this respect there is any difference in the various types of dystrophy. I know such recur-

rence has been recorded and I would like to know whether he thinks its likelihood is great enough to contraindicate keratoplasty.

DR. RAMÓN CASTROVIEJO, New York, (closing): Dr. Crisp has asked if a very extensive keratoconus is suitable for keratoplasty. If the keratoconus is very extensive but one feels that the whole conus can be replaced by a transplant $6\frac{1}{2}$ or 7 mm. in size, the eye is suitable for keratoplasty. If the conus is so large that in order to replace the whole conus, a transplant larger than 7 mm. will be required, the operation is likely to be followed by severe complications such as extensive synechiae leading to secondary glaucoma. In such a case it is advisable to flatten the conus by treating approximately 6 mm. of the center of the conus with a fulgurating current applied with a fine electrolysis needle. After the treatment the eye has to be bandaged with a pressure dressing and the pressure dressing continued until cicatrization has been completed. This treatment causes corneal opacity of the treated area but the eye is rendered more favorable for keratoplasty when the corneal curvature has been brought within approximately normal limits.

In regard to extensive vascularization of the cornea treated by radiation, my experience has shown that once the blood vessels have already formed, treatment by X-ray or radium is of no value. Radiation has to be given before the blood vessels have formed. After keratectomies X-ray treatment is instituted the same or the following day after the operation when the capillaries are beginning to form and they are easily obliterated by radiation. In this way, vascularization of the cornea is prevented.

To Dr. Verhoeff's remark of the likelihood of the transplant becoming involved by the cornea of the host affected with a dystrophy, it can be said that in some instances the dystrophy of the host invariably invades the transplant, such as in Fuch's dystrophy and dystrophia adiposa. In other dystrophies the transplant is likely to remain transparent. Because of the uncertainty in regard to the final transparency of the transplant in cases of dystrophies, these cases have not been classified in the most favorable group but in the less favorable. However, the transplant is likely to remain more transparent or at least clearer than the original opacity.

DR. VERHOEFF: But they have a recurrence of the same type of opacity?

DR. CASTROVIEJO: Yes, in some cases the transplant is partially or totally involved by the same dystrophy of the host.